in the life-history of *Cossus centerensis* Lintner," containing excellent biological matter, and illustrated by two well-engraved plates. The publication of this Bulletin marks a new era in the work and development of the entomological division of the agricultural department, and we hope the publication will be well sustained.——*Psyche*, vol. III, Sept.-Oct., 1882 (issued late in 1883), contains a noteworthy paper by Dr. Geo. Dimmock, on some glands which open externally on insects. Vol. IV, Nos. 115-116 contains Mr. Lintner's "New sexual character in the pupæ of some lepidoptera;" a very just tribute to the memory of J. L. LeConte, by C. V. Riley; the gills of insect larvæ, by G. McCloskie; the screw-worm-fly (*Compsomyia macellaria*), by S. W. Williston.——The oldest Tracheates known are probably two fossil myriopods from the Lower Old Red Sandstone (Devonian) of Scotland, described by B. N. Peach in Proceedings Royal Physical Society of Edinburgh, 1881-82.

ZOÖLOGY.

Occurrence of Chlorophyll in Animals.—C. A. MacMunn bases his conclusions as to the identity of animal and vegetable chlorophyll on the fact that the wave-lengths of centers of the bands of the same solutions of animal and vegetable chlorophyll are the same, and that the wave-lengths of the centers of the bands are the same when the same reagent is added to the respective solutions. Without committing himself to accepting the views of Kraus or Sorby, he applies the term chlorophyll to that coloring matter, or mixture of coloring matters, which can be extracted out of green leaves, such as those of Primula, by means of alcohol, or alcohol and ether. The coloring matter, to which the writer has given the name "enterochlorophyll," and which can be extracted from the liver or other appendage of the enteron of invertebrates, was shown to be probably produced by, and in, the body of the animal, and not food chlorophyll. The absence of parasitic algæ in sections of the livers of certain mollusks which yield enterochlorophyll, shows that this pigment cannot be due to their presence. The writer further showed that Pocklington's observations, published in the *Pharmaceutical Journal* in 1872, on the presence of chlorophyll in the wing-cases of Cantharides beetles, would be verified, and he had succeeded not only in verifying the presence of the principal chlorophyll band in the ether, chloroform, and alcohol solutions of the wing-cases; but the changes produced in the spectra of these solutions on the addition of certain reagents showed the presence of a body indistinguishable from vegetable chlorophyll. Hence, Leydig's conclusion as to the presence of that coloring matter in insects was proved to be correct. However, in the case of green larvæ the occurrence of a band in the red when a strong light is concentrated on the integument may be merely due to the presence of food chlorophyll

in the intestine, for, on squeezing out the contents of the latter, the green color and the band both disappear. It was then shown that chlorophyll could hardly be of much use in respiration, as oxydizing and reducing agents do not affect it; that for protective purposes or in mimicry a body of less complex chemical composition might answer equally well, except that the eyes of some invertebrates may be more susceptible to rays of light of a certain wave-length than our own, especially as Sir John Lubbock has shown that ants perceive the ultra violet rays of the spectrum which are invisible to us. It may possibly be the persistence of a pigment which was once useful in a remote ancestor in some cases, perhaps at a time when the atmosphere contained much more carbon dioxide than at present. Or, again, it may be of use in absorbing the chemically active rays of the spectrum when occurring on the surface of an animal, especially as Zimiriazeff had shown that Langley's observations with the bolometer have proved that the point of maximum energy of the solar spectrum corresponds with the principal chlorophyll band between B and C. In the case of enterochlorophyll this coloring matter may be of use in furnishing material for the construction of other coloring matters, especially as this body and Læmochromogen exist side by side in the bile of some mollusks; and in the bile of the sheep and ox a body exists which fluoresces red and resembles chlorophyll closely, but possesses at the same time some properties that show that it is a hæmoglobin derivative, as proved by the writer. The conclusions which have been arrived at gave support to the view which Professor Lankester has maintained, namely, that chlorophyll may occur quite independently of the presence of parasitic algæ, as in Spongilla and Hydra, and that it is in some cases produced synthetically by and in the bodies of animals.—*Journal of the Royal Microscopical Society, December, 1883.*

Vital Manifestations of the Sponges.—Taking the sponges as an example of a group in which tissues, organs and physiological divisions of labor are almost entirely absent, B. Solger makes them the starting-point in his proposed study of vital manifestations and their increasing complication in the animal kingdom. He gives a summary of facts deduced from observations by various writers.

The functions of *the endodermal ciliated chambers and cells* appear to be respiration and the prehension of nutriment, recent researches seeming to deny them the—at any rate the exclusive—power of actual digestion. The mesoderm probably shares in the latter function; the claim of the ectoderm to this position is less indisputable. The occasional occurrence of lipostry and lipogastry does not affect this question much, but relates chiefly to the manner of disposing of the used-up water. The function of exhalation is transferred in lipostomy to other canals and

pores; that of digestion in lipogastry is taken up by the ciliated chambers, or possibly by the ectoderm and mesoderm. The discovery of digestive ferments (pepsin, trypsin) in the body of the sponge has its importance somewhat reduced by the uncertainty which prevails as to the exact distribution of these compounds in the living animal. A reserve of nutriment occurs at certain times in several widely distinct sponges, and in some cases starch has been demonstrated between the cells, but there appears reason to regard this as derived from algæ. Oily matters have been extracted by chemical processes from sundry sponges, and traces of fatty matter have been observed. Though so commonly found dissolved in fatty matters in vertebrata, coloring matters are found abundantly in the sponges, although fats are so scanty in these organisms. They occur in the endodermal ciliated cells (*Spongelia avara*, Calcisponges) or in the mesoderm (*Euspongia officinalis*, Chondrosa). Some forms (Calcarea), from being colorless, take a brown color when placed in spirit; others (Suberites, Hircinia, and Stelletta, spp.) lose their color if exposed to the light. *Aplysina aerophoba* offers a remarkable example of change of color consequent on death, viz., from a sulphur-yellow to Prussian blue. This is caused by changes in certain roundish, refractive, mesodermal cells, with bladder-like nucleus, and small surrounding granular space. The color is preserved unchanged in solution of salicylic acid. The substance which produces it is considered to be reserve nutriment. The same body (aplysinofulvin) appears to occur in Aplysilla sp. and Hircinia sp., but changes much less rapidly in Aplysilla than in Aplysina, perhaps because the reducing ferment which hinders its conversion is decomposed more slowly in the latter case. The *horny fibers* have been shown to be excreted from special mesodermal cells. No proofs have yet been given of the occurrence of a moulding of the sponge-skeleton by absorption, such as the plasticity of such forms as *Ascetta elathrus* would seem to suggest. In connection with the rearing of sponges, it is remarked that Cavolin's observation that, after having taken root, the pieces of sponge shed over the old parts a mucilaginous mass, in which the skeleton subsequently appeared, might be utilized as giving a hint where to look for the youngest parts, when these are sought after, and thus further the study of tissue-development.—*Journal of Royal Microscopical Society, December, 1883.*

Pedal Glands of Mollusca.—J. Carriére thinks that the openings in the feet of Gasteropods or Lamellibranchs are the orifices of various glands; water does not seem to be taken into the blood directly either by their pores or by the kidney; nor is a quantity of water necessary for the erection of the foot, for the blood alone can bring that about. The renal cleft is not used as the means for introducing water into the blood, but rather as a

passage by means of which the fluid which passes into the pericardium from the blood can make its way into the kidneys. There are no indications of a water-vascular system in either Gasteropods or Lamellibranchs. In pursuing his investigations the author found great assistance from the air-pump, the use of which he learned at the Naples station. The thickest and largest pieces of the feet, which would otherwise have required several day's treatment, were rendered easy of section after a few hours. —*Journal of the Royal Microscopical Society.*

SUCKERS OF CEPHALOPODS.—P. Girod describes the suckers of *Octopus vulgaris* and *Sepia officinalis*, which are at first to be distinguished from one another by their sessile condition in the former and their pedunculated character in the latter; in the Decapod there is, further, a horny ring developed, but there is not, as in the Octopod, any elastic cup or construction, the cavity of the sucker forming a single chamber.

In the Octopod the suckers act thus: The animal contracts the extrinsic infundibular muscles, the sphincter of the orifice, and the inferior muscular envelope, and the form of the sucker becomes perfectly plane. Then the infundibulum or upper portion of the sucker becomes conical, the acetabular chamber enlarges, and its orifice dilates slightly; a vacuum is thus formed, and any pulling on the sucker only tends to separate the orifice from the base of the sucker, and so to increase the vacuum. In the Decapod there is a piston-like arrangement which becomes withdrawn by the action of lateral muscles, while the horny ring becomes more firmly attached. As the author justly points out, his results will be more completely displayed when he gives an account of the minute structure of the parts which he here mentions.

RESEARCHES ON THE ISOPODA.—L. Huet, among the important additions which he has made to our knowledge of these Crustacea, has been able to prove the existence of large salivary glands, and that not only in the terrestrial, but also in the groups that are essentially marine, such as the Idoteidæ and the Cymothoidæ. This discovery is of especial importance when we remember that, with but rare exceptions, these glands are only found in land forms. On the other hand, we must remember that in certain Decapod crustaceans, small, glandular masses, which have given some indications of being salivary in character, have been already observed. Indeed, the author thinks himself justified in extending to the whole group the results which he has found true for the Isopoda.

With regard to the processes of respiration, the author made a number of experiments which resulted in showing him that, though there is a very close resemblance in the characters of the organs by which they are effected, there are but few found that can, without danger, exchange a terrestrial for an aquatic mode

of life, or *vice versâ*. Of such we have an example in Ligia, but here, as in all, the air respired must be damp.

Especial attention may be given to the sympathetic nervous system, the arrangement of which is as yet only incompletely known. It is much more complex than that of the Decapoda, and the splanchnic system appears to be analogous to that of the recurrent intestinal nerves of Limulus, arising, as the nerves do, from the hindermost of the nerves of the body. On the other hand, there is a close resemblance between the minute structure of the nervous system of the Isopoda and the Decapoda.

Lereboullet has already pointed out that the silky secretion formed by the cutaneous glands of certain terrestial forms presents a character in which they approach the Arachnida; and M. Milne-Edwards has regarded the so-called white bodies of the opercular gills as rudiments of a tracheal system. By their external form, some Isopods, as, for example, Armadillo, approach such myriopods as Glomeris; and, taking them on the whole, the Isopoda present a certain number of intermediate characters, by which they may be justly brought into association with various other groups of arthropods, and which, at least, give them a very special position among the Crustacea.—*Journal of the Royal Microscopical Society, December, 1883.*

Commensalism between a Fish and a Medusa.—In a consignment from the Mauritius, G. Lunel found united *Caranx melampygus* and *Crambessa palmipes*. The fish stuck with the greater part of its body in the apertures which are formed by the four columns uniting the stomach with the nectocalyx, and traversed by the gastro-vascular canals. This union could not be explained by the hypothesis that the animal had sought out the other as its prey and means of nourishment; for the medusa belongs to a family which possesses no proper oral aperture, but only a series of microscopic pores, which can only take in very finely-divided nourishment, and the fish had merely taken up his quarters in a natural hollow of the medusa, which was only enlarged, but in no way injured, by the long residence of the fish.

It was ascertained that the fisherman had taken the two animals together in that position, and that several years ago there had been seen on the coast, in a depth of about six inches below the surface, a fish of the same kind in conjunction with an anemone, and going in and out of it. The anemone into which the fish had entered was living, for it could be seen moving.

Lunel arrives at the conclusion that there are certain kinds of fish, the fully grown individuals of which live at more or less considerable depths; whilst the young, either on account of an unknown peculiarity of their organization, or because they require a diet more congenial to their age, ascend with particular medusæ to the upper regions of the sea, to find there the countless small

pelagic animals on which they and their hosts are nourished. It is noticeable that the fish, in order to enter the medusa, must swim upon its side, therefore in a very abnormal position.—*Journ. Roy. Microscopical Society.*

SNAKES IN NEBRASKA.—Miss C. C. Hopley writes thus in the *London Field:* From Nebraska a writer says that the number of snakes killed during the late overflow (July) of the Nemaha river is beyond belief. It is estimated that more than 3000 were killed near Falls City that had been driven by the water to the higher ground. They were chiefly Eutæniæ and Tropidonotus, with a few rattlesnakes. The writer, who had long been a resident of the locality, and who knew the country well, was "amazed" at the number of reptiles, and where they could have previously hidden themselves, as the overflowed district did not average a mile in width, and he had thought it sparse in snakes. One curious and comfortable retreat was in the long hair of a horse's mane. The animal had been confined in a pasture in the flooded district, and when released, several snakes were found thus hidden, and apparently tolerated.

THE PELVISTERNUM OF EDENTATES.—M. P. Albrecht notes the presence, between the pubes of certain Edentates, of elements which he believes to be pelvisternal. In *Manis pentadactyla* two small bones, cartilaginously united to each other and to the pubes, separate the latter; in *Dasypus sexcinctus* and *Cholœpus didactylus* a single bone exists; in *Bradypus cuculliger* this single bone has attained a comparatively large size; in a *B. tridactylus* examined, the bony pelvisternum was soldered continuously with the pubes, with traces of the union on one side; while in many Edentates the pubes are united by a continuous bony bar, without a trace of the junction. M. Albrecht believes that these facts show the order of evolution of this part of the pelvis of the Edentata, and that the paired ossifications in question represent a *sternum* of the posterior extremities formed of a single sternebra. The evolution of this bone is parallel with that of the body of the hyoid in Mammalia, and though it appears to be placed between a pair of elements only, instead of mid-way between two pairs, as is the case with the hyoid body, this difference disappears upon examination of the state of things in the Batrachia and Lacertilia. These have an ischio-pubic symphysis, and the symphysial cartilage seems to be homologous with the pair of small bones found in the Edentates. This pelvic sternebra finds, in the anterior limb, its homodynamic representative in the paired element which unites the precoracoid with the coracoid, that is, in the epicoracoids. For these corresponding parts of the anterior and posterior sternums, M. Albrecht proposes the names of *omosternum* and *pelvisternum.*

In front of the cartilaginous pelvisternum of the salamander is a Y-shaped cartilage, which Albrecht homologizes with the epi-

pubic cartilage of Lacertilia and with the marsupial bones of the Mammalia, and believes to be homodynamic with the episternum (Wiedersheim) of the Anura and the pair of substernal bones found at the anterior extremity of the sternum of some mammals, and even in man. These elements are, therefore, styled by M. Albrecht *pre-omosternum* and *pre-pelvisternum* respectively. The element existing behind the pelvisternum in the Lacertilia is similarly styled *post-pelvisternum*, while the *xiphisternum* of the Anura is the *post-omosternum.* These parts are considered by M. Albrecht to be formed by the ventral parts of the limb bones, and thus are not homologous with any part of the *costosternum*, which is composed of copulæ that link together the ribs.

The pelvisternum of the Mammalia had been noticed by two or three authors prior to M. Albrecht's paper.

SCALES, FEATHERS AND HAIRS.—The idea current among naturalists generally, and largely taught to students, that scales, feathers and hairs are identical in nature, is combatted by Mr. J. E. Jeffries in a recent issue of the Proceedings of the Boston Society of Natural History. Mr. Jeffries considers the epiderm to be the primitive skin, if not the true one, as it is formed long before the corium, which is a late and very variable product of the mesoblast; and because all the organs of sense are formed from it. The epiderm may be regarded as primitively consisting of a smooth mucous layer, an epitrichial layer, and perhaps an intermediate layer of parenchymatous cells. In birds and mammals the outer layer is lost, and never renewed, while the middle layer becomes thickened and subject to various modifications, as drying, conversion into horn, etc., and enters into the structure of all the appendages. Scales are molted and renewed, scuta are not. The toe-pads of birds may be seen to pass over into scuta on the sides of the toes of many birds. Scuta bear feathers as epidermal appendages—scales never do, thus pointing to scuta, which have a mucous layer and outer horn coat with a mesodermal core, as simple folds of the skin, not as appendages.

The early stages of a feather and of a hair differ. The latter is formed *in a solid* ingrowth of the epiderm, the latter from the epiderm of a large papilla. A hair does not contain any of the mucous cells, while a considerable portion of a feather consists of them. The supposed homology between feathers and scales seems to fail before the facts that the mucous layer is absent in the latter, and that Studer has shown that the imagined scale-like nature of the remiges of penguins is a fallacy. Mr. Jeffries avows his belief in the distinct origin of the dermal appendages of the higher vertebrates, and asserts that the nakedness of the Amphibia is a strong argument against the identity of any of the avian appendages with those of reptiles or mammals.

DR. COUES' RENUMERATION OF THE SPINAL NERVES.—The suggestion contained in Dr. Coues' article in the last number of the NATURALIST promises to relieve the student of human anatomy of certain difficulties in connection with the spinal nerves and plexuses. More important considerations will, however, deter comparative anatomists from adopting the suggestion.

The renumeration goes upon the principle that a spinal nerve is a strictly "intervertebral" structure, and that it is indifferent whether we associate it with the vertebra in front or that behind it. Such is, however, not the case. Each spinal nerve belongs to a particular vertebral segment of the body, that through whose neural arch or behind whose neural arch it issues, and ought to be named after that segment. There are many of the lower mammalia, Monotremata, Bruta, Ungulata, in which the spinal nerves perforate the neural arches of the segment to which they belong instead of issuing behind them. Thus the first dorsal nerve of a horse perforates the neural arch of the first dorsal vertebra. If we adopt Dr. Coues' nomenclature, we should have to say that the second dorsal nerve perforates the neural arch of the first dorsal vertebra—as unhappy an expression as any caused by reckoning eight pairs of cervical nerves.

In this respect the older nomenclature was less objectionable, for there the first spinal nerve was described as "suboccipital;" the second as first cervical, the eighth as seventh cervical, the ninth as first dorsal, &c., to the vertebral segments bearing which names the nerves really belong.

It is unnecessary to dwell longer on the above line of argument, for it has been fully elucidated by Dr. Albrecht (Zoölogischer Anzeiger, vol. III, 450 and 472), who regards the suboccipital nerve as the sole remnant of a *proatlantic* vertebral segment, traces of the osseous elements of which he finds in front of the atlas in the alligator and hedgehog. Whether Albrecht's proatlas be accepted by anatomists, or whether it be more probable that the segment to which the suboccipital nerve belongs has been swallowed up in the occipital region of the skull, does not affect the basis of his contention that a spinal nerve belongs to that vertebral segment through or behind whose neural arch it issues.

Of interest in this connection is Sagemehl's discovery of three rudimentary occipital nerves (with corresponding osseous elements) between the vagus and the first spinal nerve in Amia (Morph. Jahrb. ix, 190). Sagemehl concludes that all Teleostei must have originally possessed occipital arches. If what Sagemehl describes as the first spinal nerve of Amia is really homologous with the nerve of the same name in Teleostei, it is singular that no traces of the occipital nerves have been found in the latter unless, indeed, we are to assume that they have disappeared in the vagus.—*R. Ramsay Wright, University College, Toronto.*

ZOOLOGICAL NOTES.—*Protozoans.*—Kunstler describes *Trichomonas vaginalis* as extremely protean in external form. Pseudopodia arise over the general surface, or are localized at the posterior end.——G. Klebs discusses (*Bot. Zeitung*, 1883), the relationship of the Flagellata to the Algæ and Infusoria. Some Flagellata in the older sense are referred to the lower chlorophyllaceous Algæ; such are, in addition to the Volvocinæ, the Chlamydomonads. The fresh-water forms of the Peridineæ are, with Leuckart, regarded as plants. The Euglenaceæ and Peranemeæ are separated from the Ciliata and placed among the Infusoria.

Crustaceans.—A remarkable shrimp (*Nematocarcinus gracilipes*) was dredged by the *Talisman* at a depth of 850 meters, which is analogous to certain blind cave phalangids in the enormous length and slenderness of the antennæ and legs. The eyes are large and well developed, though the stalks are short. In a new form (*Acanthephyra pellucida*) the feet are adorned with phosphorescent bands.

Mammals.—Miklucho Maclay finds that the average temperature of the body of *Echidna hystrix* is 78° F., or very little more than that of fish, and about 25° less than mammals generally.——So far as known, congenital deafness is only known to exist besides man in the cat, and always in white ones, and most usually in females.

PHYSIOLOGY.[1]

THE PHYSIOLOGY OF THE CARBOHYDRATES.—In the London *Lancet* of Januury and February, 1884, Dr. Pavy records some interesting experiments which prove the presence in the stomach and intestines of animal ferments which have been hitherto unknown. Dr. Pavy's general object was to discover the history of carbohydrates in the animal system:

1. Solutions of grape sugar placed in contact with the mucous membrane of the stomach or intestine of a recently killed rabbit, become changed into a carbohydrate which has less power of reducing Fehling's solution than grape sugar. Boiling the mucous membrane destroys its power of acting on glucose. This power of the mucous membrane is due to a ferment which is contained within the glands of the stomach and intestine, but is not secreted by the superficial epithelium covering the walls. The action of the ferment was gradual and progressed better at the temperature of the body than at lower temperatures. The ferment was not destroyed by drying and can be preserved when the mucous membrane is brought into this condition. In ruminant animals the ferment is not found in the true or fourth stomach, which corresponds to the single stomach of other animals, but in the three anterior chambers of the quadruplex organ.

2. The stomach and intestine are shown also to yield a ferment

[1] This department is edited by Professor HENRY SEWALL, of Ann Arbor, Michigan.